



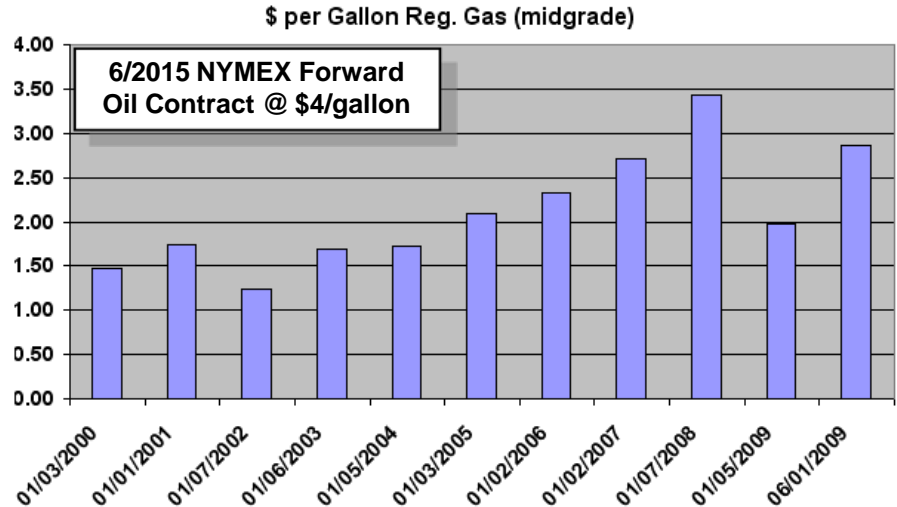
**California Energy
Commission**

Electric Vehicle Market Growth in California Electric Drive Vehicles Infrastructure Workshop

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Director, Clean Air Transportation
Pacific Gas and Electric Company
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- As early as 2010, California is likely to be a major focus of initial mass marketing of a new generation of electric vehicles
- Electric vehicles will have the potential to provide significant environmental and economic benefits
- In preparation, the CPUC, CEC, utilities, utility customers, auto manufacturers, vendors and other stakeholders need to work together to establish overall policies, rates, and incentives to ensure that electric infrastructure and customer services needed to support the market penetration of electric vehicles will be in place.
- PG&E is in communication with auto OEMs.

Plug in Electric Vehicles (PEVs) are coming to market

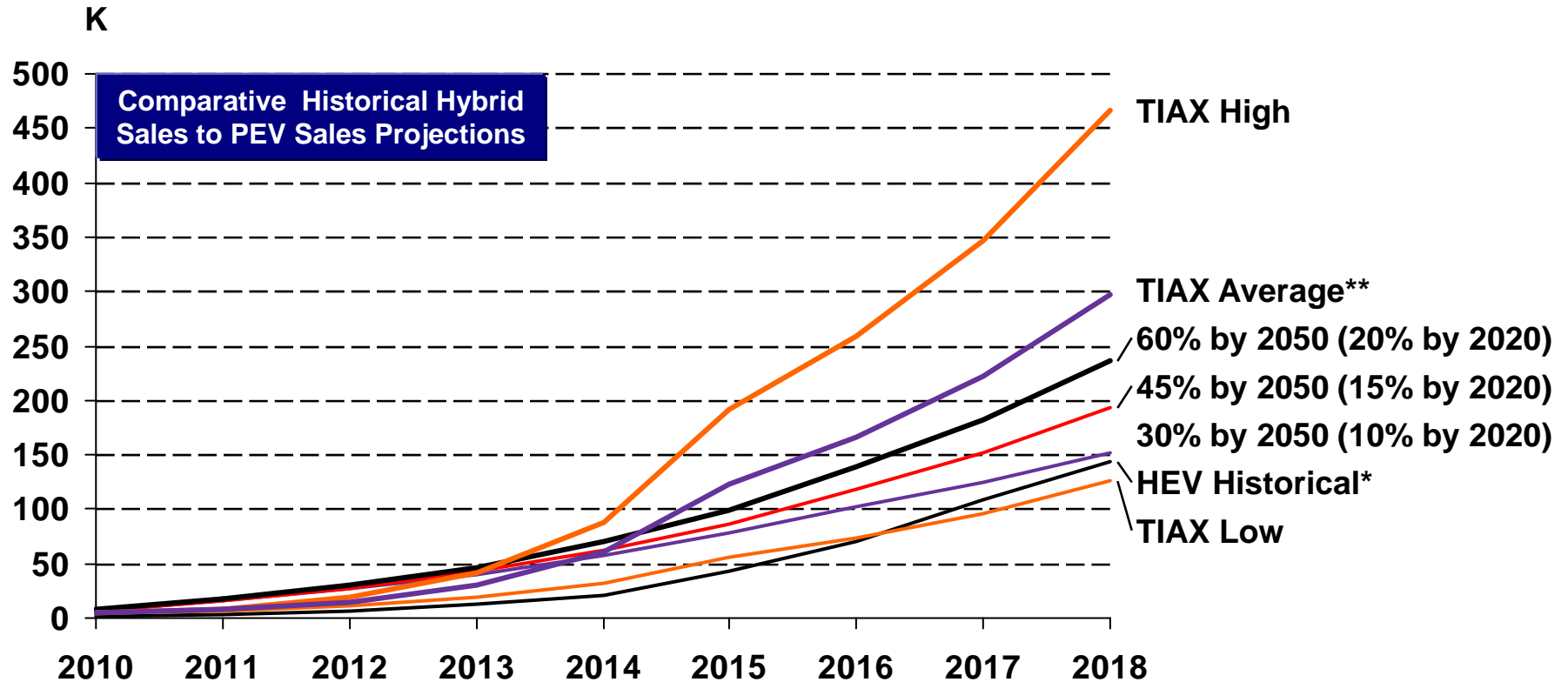


- **The return of +\$3.00 gallon gas**
 - Independent of incentives, battery economics @ 750 kWh are net positive to consumer when gallon of gas +\$4.00 a gallon
- **Automobile manufacturers supportive of PEV segment and addressing multiple consumer segments**
 - Performance (Tesla, Fisker, etc...)
 - Family Sedan (GM, Ford, Toyota, etc...)
 - Compact (Mercedes, Nissan, Volvo, etc...)
 - SUV (Ford, Jeep, etc...)
 - Mini-Van (Ford, Chrysler, Bright, etc...)





Cumulative PG&E Service Territory PEV Market Adoption?



¹ Assumes 10 million annual new car light duty sales, CA receives it's fair share of 12%, 40% reside in PG&E's service territory

* Shift HEV historical sales data (starting 2000) by 10 years to compare with PEV projections (HEV market started in 2000; PEV market will start in 2010)

** Average of TIAX High and TIAX Low

Plausible Game Changers

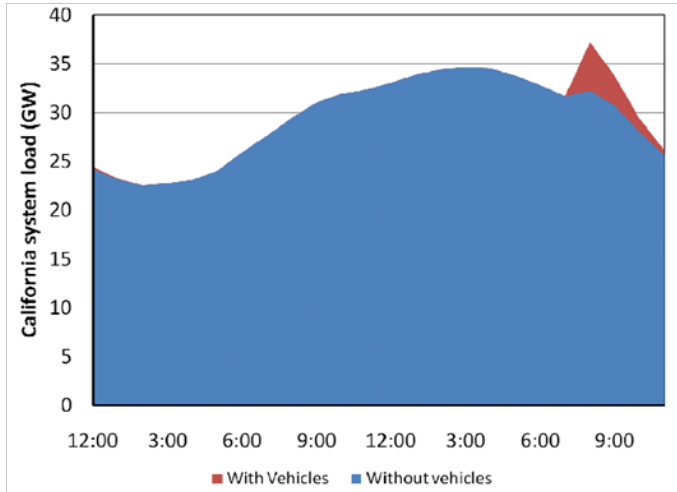
- CA buys more than its fair share (27% vs. 12%)
- Increased federal/state incentive mechanisms (tax credits, HOV policies)
- Changing consumer behavioral norms (commodity and statement)
- Battery technology advancement
- Acceleration of peak oil window

- Expected increased loads due to PEV charging, with yet to be quantified impacts to the distribution system
 - Load management strategy will be necessary
 - Determine how to mitigate adverse impacts to the distribution system
- PG&E is examining the entire HAN platform and how to address various goals, including: (1) dynamic billing info for customers, (2) load management opportunities, and (3) standardization for 2-way communication



EV Charging Will Require Load Management Strategies

Proper load management is necessary*



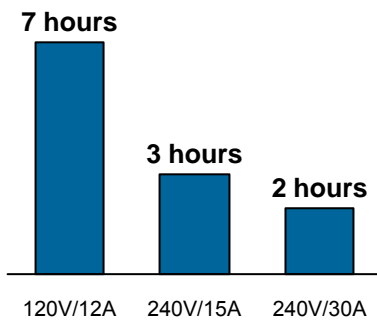
* Marcus Alexander, EPRI, CPUC SmartGrid Workshop, July 2009

Charging levels

Charge Method	Nominal Supply Voltage (Volts)	Maximum Current (Amps-continuous)	Branch Circuit Breaker rating (Amps)
AC Level 1	120 V AC, 1-phase	12 A	15 A (minimum)
	120 V AC, 1-phase	16 A	20 A
AC Level 2	208 to 240 V AC, 1-phase	≤ 80 A	Per NEC 625
AC Level 3	Under Development		
DC Charging	Under Development		

Source: SAE

Customers will prefer a 240V charge

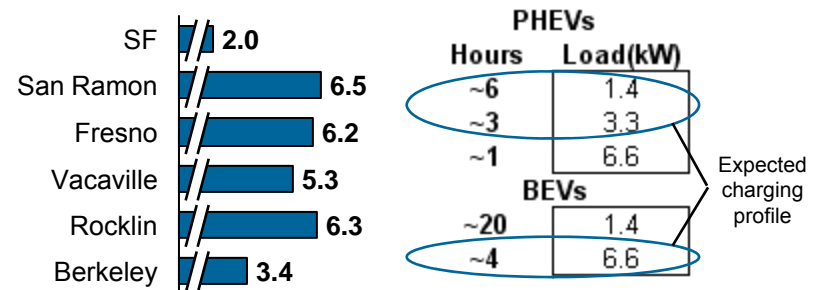


Rate of charge **

Assume 8kWh usable battery pack

Most customers will choose to upgrade to 240V; auto OEMs will offer 240V

EV charging is a large load for PG&E customers



Avg. residential peak (summer, kW)



PG&E's CARB Funded Infrastructure Project

- Focus on Highway 80 corridor from San Francisco to Sacramento
- Focus on sites with easy accessibility and proximity to services
- Successfully installed 14 new SAE compliant and UL approved EVSEs from Clipper Creek (Model TS70)
- Made provisions for future cordset and coupler upgrades to new SAE J1772™ standard
- Where possible, station infrastructure sized to provide highest power charge rates to a 70 amp max.
- Completed planning and site prep for installation of two Pilot DC fast charge stations
- All work completed in two month time frame

Funding:

- AB 1811, "E85 and Other Alternative Fuels: Fuel Infrastructure Projects and Price Parity Incentives;" Retail Project
- CARB Grant G06-AF18, Pacific Gas and Electric Company, Electric Vehicle Charging Station Infrastructure



- EVSE product availability can be an issue
 - SAE compliant equipment
 - EVSE
 - Coupler
 - UL approved
- Future upgradeability and capability
- Engage stakeholders early e.g. EAA and others, Can help with many issues
- Awareness of legacy vehicle needs, there are still old EV running around out there!
- Educate local planning and permitting agencies, generally not aware of codes or standards involved with EV infrastructure
- Posting of charge rates on equipment
 - New standards allow for rates as high as 80 Amps
 - Some vehicles default to highest charging rate e.g. Tesla
 - Can cause breaker tripping issue
- ADA issues that need to be addressed
- Communicating changes to charging network
 - Online station location maps
- Maintenance considerations, who will maintain or pay to fix?
- Siting agreement for new installations take time!



Opportunities and Challenges: Next Steps by Policymakers, Auto Manufacturers, Utilities and Stakeholders

- Support and accelerate standardization of vehicle charging infrastructure
 - Open, “plug and play,” national, convenient for consumers
- Incent and authorize needed investments in charging infrastructure
- Expedite approval of new utility time-variant tariffs and other load management measures
- Streamline building permit and retrofit regulations at state and local levels
- Establish policies, safety and reliability standards, regulatory framework and “level playing field” for utility and third party service providers